

**Abstract Submittal Form**

JANNAF

Liquid Propulsion Subcommittee and Advanced Materials Panel  
Technical Interchange Meeting  
3 – 5 September 2014

**Abstract Due Date: Wednesday, June 4, 2013**

Title: Neutron Imaging for Selective Laser Melting Inconel Hardware with Internal Passages

Session Area: ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

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### Unclassified Abstract (250 – 300 words; do not include figures or tables)

Additive Manufacturing is showing great promise for the development of new innovative designs and large potential life cycle cost reduction for the Aerospace Industry. However, more development work is required to move this technology into space flight hardware production. With selective laser melting (SLM), hardware that once consisted of multiple, carefully machined and inspected pieces, joined together can be made in one part. However standard inspection techniques cannot be used to verify that the internal passages are within dimensional tolerances or surface finish requirements. NASA/MSFC traveled to Oak Ridge National Lab's (ORNL) Spallation Neutron Source to perform some non-destructive, proof of concept imaging measurements to assess the capabilities to understand internal dimensional tolerances and internal passages surface roughness.

This presentation will describe 1) the goals of this proof of concept testing, 2) the lessons learned when designing and building these Inconel 718 test specimens to minimize beam time, 3) the neutron imaging test setup and test procedure to get the images, 4) the initial results in images, volume and a video, 4) the assessment of using this imaging technique to gather real data for designing internal flow passages in SLM manufacturing aerospace hardware, and lastly 5) how proper cleaning of the internal passages is critically important.

In summary, the initial results are very promising and continued development of a technique to assist in SLM development for aerospace components is desired by both NASA and ORNL. A plan forward that benefits both ORNL and NASA will also be presented, based on the promising initial results. The initial images and volume reconstruction showed that clean, clear images of the internal passages geometry are obtainable. These clear images of the internal passages of simple geometries will be compared to the build model to determine any differences. One surprising result was that a new cleaning process was used on these simply geometric specimens that resulted in what appears to be very smooth internal surfaces, when compared to other aerospace hardware cleaning methods.

- By submitting an abstract, you agree to complete a final paper/presentation for publication and to attend the meeting to present this information.
- Submit abstracts electronically; submittal instructions are found in the call for papers.
- Direct questions to Kathleen Biglari, by phone at 410.992.7300 x 208, or email to [kbiglari@cpiaac.jhu.edu](mailto:kbiglari@cpiaac.jhu.edu).